# Integrating Multi-Source Remote Sensing and AHP-MCDA for GLOF Hazard Assessment of Major Glacial Lakes in Nepal

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**Key words:** Engineering survey; Geoinformation/GI; GNSS/GPS; Photogrammetry; Positioning; Remote sensing; Young surveyor; Glacial Lake Outburst Flood; Normalized Difference Water Index; Normalized Difference Snow Index; Analytic Hierarchy Process (AHP)

**SUMMARY**

Potential risk assessment of Glacial Lake Outburst Flood (GLOF) plays an important role in flood risk management and aims to mitigate the hazards posed to the vulnerable communities. This research aims to evaluate the potential risk of GLOF hazards for the three largest glacial lakes in Nepal: Tsho Rolpa Lake, Imja Tsho Lake, and Thulagi Lake by integrating multi-source remote sensing datasets. The change in lake surface areas over time were delineated using Normalized Difference Water Index (NDWI) and Normalized Difference Snow Index (NDSI), along with digitization from high-resolution 3m PlanetScope imagery. The area of Tsho Rolpa Lake was calculated to be 1.648 km2 in 2022, with an error of 0.003 km² when validated with data from the Department of Hydrology and Meteorology, Nepal. The percentage of area change in Tsho Rolpa, Imja Tsho, and Thulagi lakes from 2016 to 2024, was observed to be 3.36%, 10.15%, and 5.221% respectively, over each 4-year interval. The lake surface velocity was determined through the offset tracking method using Sentinel-1 images, which resulted 0.816 m/day, 0.012 m/day and 0.345 m/day velocities for Tsho Rolpa, Imja Tsho and Thulagi respectively. These data, were combined with primary data such as precipitation, volume, slope and distance to the glacier, to perform AHP based MCDA in GIS, resulting in potential outburst risk values of 1.75 for Tsho Rolpa, 1.69 for Thulagi, and 1.43 for Imja Tsho.